the method by which the aborigines manufactured copper implements. The doctor takes the ground that none of these implements were cast, since the moulds were too difficult of management for the intelligence of American savages. "Copper is a refractory metal which melts at 2200 to 2600 degrees, a temperature that can be reached only in a furnace, assisted by some form of coal and an artificial blast. It is, when melted, thick and pasty, and without the addition of some other metal will not run in the cavities and sinuosities of the mould. A majority of the copper implements found have specks or points of pure silver over their surfaces; now one single speck of pure silver, visible even with the microscope, is positive evidence that the specimen was never melted." Dr. Hoy then proceeded to give his views of the methods of savage metallurgy. The Indians used fire in their mining operations. The vein rock was made hot by building a fire on or against it. Then by dashing water on the heated mass the rock would be fractured and removed, leaving ragged masses of copper exposed, which would also be softened so that it could be beaten into shape. When the metal became hard by pounding, it was again heated and plunged into water; for copper is, in this respect, the opposite of steel. In this way copper was fashioned simply by pounding.

In addition to the hammering process, cylindrical articles were evidently rolled between two flat rocks. Some of those implements that are supposed to have been cast were probably swedged; that is, a matrix was excavated in stone, into which the rudely fashioned copper was placed, and then by repeated blows the article was made to assume the exact shape of the mould. Besides this swedging process, Dr. Hoy is persuaded that in a few instances a complete mould was wrought out in halves on the face of two flat stones, so that by placing a suitable piece of copper between them and giving it repeated heavy blows the metal was made to fill the mould accurately. In order to test the matter the doctor constructed a mould of this description and was able to make a beautiful axe.

In the same volume of the Transactions, Dr. J. M. de Hart discusses the antiquities and platycnemism of the Mound-builders of Wisconsin.

Mr. Lester F. Ward sends us a pamphlet printed by Edward Stern & Co., of Philadelphia, containing his papers on Haeckel's Genesis of Man, which appeared in the April, May and July numbers of the *Penn Monthly* for 1877. As this celebrated work of the author has not yet been translated into English, Mr. Ward has done a useful thing in presenting the views of Prof. Haeckel in a clear and succinct manner.

GEOLOGY AND PALÆONTOLOGY.

A PECULIAR CAVE IN UTAH.—The Oquirrh range of mountains, in Utah, extends northward as far as Great Salt lake and borders

the lake for a short distance along the south-east shore. Near Lake Point, as in many other places, old lake beaches or "benches" can be traced on the side of the mountain, the highest having an altitude of about 900 feet. In some places four distinct ones can be seen. On one of the benches a cave opens into the carboniferous limestone, of which the mountain is mostly composed. This cave, known as Clinton's cave, was first brought into public notice by Mr. G. K. Gilbert,[1] who described it and explained the probable mode of its formation. Later Dr. A. S. Packard, Jr., published an interesting account[2] of several species of cave animals which he found living there. He also determined its geological age to be most probably the Quaternary. Having recently visited it and made a discovery which seems to throw some light on the mode of its formation and its age, I am enabled to verify their conclusions and to give further particulars.

The strata forming the mountain are here uplifted into nearly a vertical position. One stratum having a thickness of ten or twelve feet, seems to have been composed of a softer material than the adjacent ones. When the water of the lake stood at about the level of the bench on which the cave is now situated, the action of the waves in breaking upon the rocky shore gradually wore away this soft stratum until a long narrow crevice had been excavated into the side of the mountain. Similar action is going on to-day on the coast of New England, where dykes of porphyry are exposed to the direct action of sea-waves, the porphyry being worn away faster than the wall-rock.

After thus cutting horizontally to a depth of over 300 feet, and vertically to the surface of the slope for the whole distance, the lake evidently subsided sufficiently to allow of an accumulation of coarse sediment which was washed from the slope above, filling the crevice, and which was cemented into a conglomerate by carbonate of lime. Then the lake rose again to the level of this bench and dug its way into the conglomerate; but instead of cutting upward to the surface it tunneled horizontally as far as before and formed a cave, the height of which to the roof is nowhere more than twenty-five or thirty feet. The width varies from about twelve feet at the mouth to three feet at the innermost extremity.

An indication that this is the probable mode of its formation is afforded by the discovery to which I previously referred. While in Utah during the past summer, I visited the cave with Dr. Packard for the purpose of more fully investigating its fauna. The floor is composed mainly of earthy materials with an occasional layer of marl, in which Dr. Packard found several species

[1] Report on the Geology of Portions of Nevada, Utah, &c. G. K. Gilbert, A.M. Wheeler's Report, Vol. III, p. 98.

[2] On a New Cave Fauna in Utah, by A. S. Packard, Jr., M.D. Bulletin of U. S. Geol. and Geog. Survey, F. V. Hayden, U. S. Geologist-in-charge. Vol. III, No. 1.

of fresh-water shells. Several large masses of the conglomerate which forms the roof have fallen to the floor. While examining one which seemed to have fallen very recently, as it was not imbedded in the earth, I found enclosed in the rock, a land shell which has kindly been identified by Mr. W. G. Binney as *Patula strigosa* var. *Haydeni*. Further search failed to bring to light other specimens.

The great thickness of the conglomerate above the position of the shell precludes the idea that the filling took place at a very recent period. The same species is now found living in abundance in the vicinity of the lake. Its presence as a fossil undoubtedly proves the formation to belong to the Quaternary.

The discovery seems to be of interest on another account. Although the conditions of life must have been much varied since the deposit of the specimen in the conglomerate, the species retains, at the present time, even its varietal markings in great distinctness, a further evidence that all groups are not equally affected by climatic changes.—*Leslie A. Lee.*

THE BAHNA BASIN.—M. Stephanesco, of Bucharest, has communicated to the Geological Society of France a description of the geology of the region of the Iron Gate of the Danube, on the extreme west of Roumania. Azoic beds are extensively developed on this part of the Danube, which are overlaid at one point by a band of Cambrian, which crosses the river below the gates. Lower down, a Tertiary formation appears, resting partly on the Azoic and partly on some secondary beds. Above the gates the Bahna creek enters from the north, after traversing a valley in which is situated the town of that name. This valley is excavated in upper and middle Miocene marine beds, which themselves form a synclinal series, with the opposing dips of 45° separated by a central fracture. M. Stephanesco points out that the relations of these beds, lying as they do directly on the Azoic, is similar to that seen in the basins of Vienna, Bordeaux, Dax and that of the north of Italy.

A NEW ANCHITHERIUM.—At a recent meeting of the Philadelphia Academy, Prof. Cope exhibited crania of three species of *Anchitherium* from the Truckee beds of Oregon, one of which he regarded as new to science, and named, on account of its superior size, *A. præstans*. It is the largest species yet found in America, and exhibits the typical characters of the genus. On the posterior border of the superior molars there is a trihedral tubercle in front of the elevated posterior cingulum, but the anterior cingulum does not rise into a tubercle, nor is there an accessory tubercle near it. The internal lobes of the crown are closely connected with the median lobes. External ribs and cingulum prominent; enamel smooth. The side of the face is concave, and there is a lachrymal fossa. The anterior border of the orbit

marks the middle of the last molar tooth. Length of molar series, .118 m.; of true molars, .050; length anterior to molars, .061; width between last molars, .040; diameters of crown of second true molar, fore and aft, .017, transverse, .022; length of tibia, .285; of metacarpal, .221.

GEOGRAPHY AND TRAVELS.[1]

GEOGRAPHICAL PROFESSORSHIPS. — The Council of the Royal Geographical Society have presented a Memorial to the Oxford and Cambridge University Commissioners urging the importance of establishing Geographical Professorships. Although there is no such chair existing in any American university, and although it may be as well said of America as of England, that "there are few countries in which a high order of geographical teaching is so little encouraged," the importance of such knowledge is recognized here, and the popular interest in scientific exploration is rapidly extending. It may be well, therefore, to call the attention of our educational authorities, especially those of our new and magnificently endowed universities, such as the Johns Hopkins and the Lehigh to this address. It is given in full in the "Proceedings" of the society for April last.

The Council include in the word Geography "a compendious treatment of all the prominent conditions of a country, such as its climate, configuration, minerals, plants and animals, as well as its human inhabitants; the latter in respect not only to their race, but also to their present and past history, so far as it is intimately connected with the peculiarities of the land they inhabit." * * * * * "Among the many classes of problems that fall under these heads, it is sufficient to specify two. The one deals with the reciprocal influence of man and his surroundings, showing on the one hand the influence of external nature on race, commercial development and sociology, and, on the other, the influence of man on nature, in the clearing of forests, cultivation and drainage of the soil, introduction of new plants and domestic animals, and the like. The other problem deals with the inferences that may be drawn from the present distribution of plants and animals, in respect to the configuration of the surface of the earth in ancient times. Thus we see that the mutual relation of the objects of the different sciences is the subject of a science in itself, so that scientific geography may be defined as the study of local correlations.

"Geography thus defined does not tend in any degree to supersede the special cultivation of the separate sciences, but rather to intensify the interest already felt in each of them, by establishing connections which would otherwise be unobserved. It is through geography alone that physical, historical and political conditions are seen to be linked closely together; and it is thus that geog-

[1] Edited by ELLIS H. YARNALL, Philadelphia.